

Arboviral Disease

(except West Nile virus and Yellow Fever)

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To distinguish arboviral infections acquired locally from those related to travel.
2. To better understand the epidemiology of these infections in Washington State in order to target education and control measures.
3. To identify emerging arboviral infections in Washington.

B. Legal Reporting Requirements

1. Health care providers: notifiable to local health jurisdiction within 3 work days.
2. Hospitals: notifiable to local health jurisdiction within 3 work days.
3. Laboratories: isolation of an arbovirus, or detection of viral antigen, antibody or nucleic acid notifiable to local health jurisdiction of the patient's residence within 2 work days.
4. Local health jurisdictions: notifiable to Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES) within 7 days of case investigation completion or summary information required within 21 days.
5. Veterinarians: notifiable to the local health jurisdiction or to Washington State Department of Agriculture.

C. Local Health Jurisdiction Investigation Responsibilities

1. When possible, alert CDES about endemically acquired cases.
2. Facilitate transport of specimens (e.g., serum or CSF) to the Washington State Department of Health Public Health Laboratories (PHL) if initial testing or confirmatory testing is needed. Please call CDES prior to submitting specimens (206-418-5500).
3. Report all *confirmed* and *probable* cases to CDES (see definitions below). Complete the Arboviral Disease case report form (<http://www.doh.wa.gov/notify/forms/arbovirus.pdf>) and enter the data into the Public Health Issues Management System (PHIMS) as "Arboviral Disease." Cases of West Nile virus disease and yellow fever should be reported in PHIMS as "West Nile Virus" and "Yellow Fever."

2. THE DISEASE AND ITS EPIDEMIOLOGY

For information regarding West Nile virus and yellow fever, please see disease specific guidelines at <http://www.doh.wa.gov/notify/guidelines/pdf/wnv.pdf> and <http://www.doh.wa.gov/notify/guidelines/pdf/yellowfever.pdf>.

Background

Arboviral (arthropod-borne viral) diseases are caused by a variety of viruses that are transmitted by arthropods (e.g., mosquitoes, sandflies, ticks). Arboviral diseases include West Nile virus disease (discussed separately), Eastern and Western equine encephalitis,

dengue, St. Louis encephalitis, La Crosse encephalitis, Japanese encephalitis, Powassan virus encephalitis, Chikungunya virus disease, yellow fever (discussed separately), and other less common infections.

A. Etiological Agent: See Table 1 for important arboviral agents.

B. Description of Illness:

Arboviral infections cause four main clinical syndromes: 1) acute central nervous system (CNS) illnesses, 2) acute benign fevers of short duration with or without rash, 3) hemorrhagic fevers, and 4) polyarthrititis and rash with or without fevers. See Table 1.

C. Arboviral Diseases in Washington State

Each year, 0 to 10 cases of travel associated dengue fever are reported in Washington. In 2004, one case of Japanese encephalitis was reported in a person who traveled to Thailand. In 2006, one case of Chikungunya fever was reported in a patient who traveled to Sri Lanka.

The last reported human infection with an arboviral disease (excluding West Nile virus) that was acquired in Washington State was western equine encephalitis in 1988. St. Louis encephalitis (SLE) has also occurred in Washington State, primarily in the central valleys, east of the Cascades. SLE antibodies were detected in sentinel chickens in Benton county in 2005 (Source: DOH Zoonotic Disease Program).

D. Vectors and Reservoirs

Most arboviruses are maintained in enzootic cycles involving arthropods and birds or small mammals. Humans are usually dead end hosts and do not contribute to the spread of the virus. However, some arboviral infections (e.g., dengue fever) can be indirectly spread from person-to-person by a mosquito vector.

E. Modes of Transmission

Arboviral diseases are most commonly transmitted by the bite of an arthropod (e.g., mosquitoes, ticks, flies). Some arboviruses have been shown to be transmitted through blood transfusions.

F. Incubation Period

See Table 1.

G. Period of Communicability

Most arboviral diseases are not directly transmitted from person-to-person through close contact.

H. Treatment

Treatment is supportive.

Table 1: Geographic Distribution and Clinical Characteristics of Important Arboviral Infections*

Disease (Etiologic agent)	Arthropod	Geographic Distribution	Incubation period	Clinical syndrome
California encephalitis (La Crosse virus and other California serogroup viruses)	Mosquito	Widespread in the U.S. and Canada; most prevalent in upper Midwest; also South America, Europe, Asia	5–15 days	Encephalitis
Chikungunya fever (Chikungunya virus)	Mosquito	Africa; Asia	3–11 days	Fever, arthralgia, rash (hemorrhage rare)
Colorado tick fever (Colorado tick fever virus)	Tick	Western U.S. and Canada	1–14 days	Febrile illness rarely accompanied by encephalitis or myocarditis
Dengue fever and dengue hemorrhagic fever (dengue viruses)	Mosquito	Tropical areas worldwide: Caribbean, Central and South America, Asia, Australia, Oceania, Africa	2–7 days	Febrile illness; hemorrhagic fever and shock (particularly with second infection)
Eastern equine encephalitis (EEE virus)	Mosquito	Eastern seaboard and Gulf states of the U.S.; Canada; South and Central America	3–10 days	Encephalitis
Japanese encephalitis (Japanese encephalitis virus)	Mosquito	Asia; Pacific Islands; Northern Australia	5–15 days	Encephalitis, fever
Powassan encephalitis (Powassan encephalitis virus)	Tick	Canada; northeastern, north central, and western U.S.; Russian Federation	4–18 days	Encephalitis
St. Louis encephalitis (SLE virus)	Mosquito	Central, southern, northeastern and western U.S. ; Manitoba and southern Ontario ; Caribbean area; South America	4–14 days	Encephalitis, fever
Venezuelan equine encephalitis (VEE virus)	Mosquito	Central and South America; Southern U.S.	1–4 days	Fever, encephalitis
Western equine encephalitis (WEE virus)	Mosquito	Central and western U.S.; Canada; Argentina, Uruguay, Brazil	2–10 days	Fever, encephalitis

*Sources:

American Academy of Pediatrics. Arboviruses. In: Pickering LK, Baker CJ, Long SS, McMillan JA, eds. *Red Book: 2006 Report of the Committee on the Infectious Diseases*. 27th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2006:212–14.

Arthropod-borne Viral Diseases. In: Heymann DL, ed. *Control of Communicable Diseases Manual*. 18th ed. Washington D.C.: American Public Health Association; 2004: 31–34.

3. CASE DEFINITION

A. Neuroinvasive and Non-Neuroinvasive Domestic Arboviral Diseases (2004)

(includes diseases caused by California serogroup viruses; eastern and western equine encephalitis viruses; and Powassan, St. Louis encephalitis, and West Nile viruses)

1. Clinical Criteria for Diagnosis

Cases of arboviral disease are classified either as neuroinvasive or non-neuroinvasive, according to the following criteria:

Neuroinvasive disease requires the presence of fever and at least one of the following, as documented by a physician and in the absence of a more likely clinical explanation:

- Acutely altered mental status (e.g., disorientation, obtundation, stupor, or coma), or
- Other acute signs of central or peripheral neurologic dysfunction (e.g., paresis or paralysis, nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions, or abnormal movements), or
- Pleocytosis (increased white blood cell concentration in cerebrospinal fluid [CSF]) associated with illness clinically compatible with meningitis (e.g., headache or stiff neck).

Non-neuroinvasive disease requires, at minimum, the presence of documented fever, as measured by the patient or clinician, the absence of neuroinvasive disease (above), and the absence of a more likely clinical explanation for the illness. Involvement of non-neurological organs (e.g., heart, pancreas, liver) should be documented using standard clinical and laboratory criteria.

2. Laboratory Criteria for Diagnosis

Cases of arboviral disease are also classified either as confirmed or probable, according to the following laboratory criteria:

Confirmed case:

- Four-fold or greater change in virus-specific serum antibody titer, or
- Isolation of virus from or demonstration of specific viral antigen or genomic sequences in tissue, blood, CSF, or other body fluid, or
- Virus-specific immunoglobulin M (IgM) antibodies demonstrated in CSF by antibody-capture enzyme immunoassay (EIA), or
- Virus-specific IgM antibodies demonstrated in serum by antibody-capture EIA and confirmed by demonstration of virus-specific serum immunoglobulin G (IgG) antibodies in the same or a later specimen by another serologic assay (e.g., neutralization or hemagglutination inhibition).

Probable case:

- Stable (less than or equal to a two-fold change) but elevated titer of virus-specific serum antibodies, or

- Virus-specific serum IgM antibodies detected by antibody-capture EIA but with no available results of a confirmatory test for virus-specific serum IgG antibodies in the same or a later specimen.

3. Case Definition

A case must meet one or more of the above clinical criteria and one or more of the above laboratory criteria.

4. Comment

Because closely related arboviruses exhibit serologic cross-reactivity, positive results of serologic tests using antigens from a single arbovirus can be misleading. In some circumstances (e.g., in areas where two or more closely related arboviruses occur, or in imported arboviral disease cases), it may be epidemiologically important to attempt to pinpoint the infecting virus by conducting cross-neutralization tests using an appropriate battery of closely related viruses. This is essential, for example, in determining that antibodies detected against St. Louis encephalitis virus are not the result of an infection with West Nile (or dengue) virus, or vice versa, in areas where both of these viruses occur. Because dengue fever and West Nile fever can be clinically indistinguishable, the importance of a recent travel history and appropriate serologic testing cannot be overemphasized. In some persons, West Nile virus-specific serum IgM antibody can wane slowly and be detectable for more than one year following infection.

B. Dengue Fever (Dengue Hemorrhagic Fever) (Dengue Shock Syndrome) (1996)

1. Clinical Criteria for Diagnosis

An acute febrile illness characterized by frontal headache, retro-ocular pain, muscle and joint pain, and rash. The principal vector is the *Aedes aegypti* mosquito and transmission usually occurs in tropical or subtropical areas. Severe manifestations (e.g., dengue hemorrhagic fever and dengue shock syndrome) are rare but may be fatal.

2. Laboratory Criteria for Diagnosis

- Isolation of dengue virus from serum and/or autopsy tissue samples, or
- Demonstration of a fourfold or greater rise or fall in reciprocal immunoglobulin G (IgG) or immunoglobulin M (IgM) antibody titers to one or more dengue virus antigens in paired serum samples, or
- Demonstration of dengue virus antigen in autopsy tissue or serum samples by immunohistochemistry or by viral nucleic acid detection

3. Case Definition

Probable: a clinically compatible case with supportive serologic findings (a reciprocal IgG antibody titer of greater than or equal to 1280 or a positive IgM antibody test on a single acute (late)- or convalescent-phase serum specimen to one or more dengue virus antigens)

Confirmed: a clinically compatible case that is laboratory confirmed

4. Comment

Dengue hemorrhagic fever is defined as an acute febrile illness with minor or major bleeding phenomena, thrombocytopenia (less than or equal to $100,000/\text{mm}^3$), and evidence of plasma leakage documented by hemoconcentration (hematocrit increased by greater than or equal to 20%) or other objective evidence of increased capillary permeability. The definition of dengue shock syndrome follows all of the above criteria for dengue hemorrhagic fever and also includes hypotension or narrow pulse pressure (less than or equal to 20 mm Hg).

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Laboratory diagnosis of most arboviral infections is primarily made by detection of viral specific antibodies in serum or CSF. See Section 3A(4) for additional information about serologic testing.

B. Tests Available at the Department of Health Public Health Laboratories (PHL)

PHL can test for West Nile virus (WNV)-specific and St. Louis encephalitis (SLE) virus-specific IgM antibody in serum or CSF by capture enzyme immunoassay (EIA) and microsphere immunoassay (MIA). PHL will send all positive antibody samples to the CDC for confirmatory testing by plaque reduction neutralization test. PHL can also test for WNV nucleic acids in blood or CSF by PCR assay. See WNV guidelines for additional information.

PHL sends specimens to the CDC for all other arboviral tests (including serologies for dengue fever).

C. Specimen Collection

Serum and/or CSF should be refrigerated and transported cold. Specimens should be submitted with a completed PHL Virus Examinations form available at: <http://www.doh.wa.gov/EHSPHL/PHL/Forms/VirusExams.pdf>.

Please call PHL for instructions for shipping specimens other than serum or CSF.

5. ROUTINE CASE INVESTIGATIONS

Interview the case and others who may be able to provide pertinent information.

A. Evaluate the Diagnosis

If the case tests positive for an arboviral infection at a laboratory other than PHL, facilitate transport of the specimen (i.e., serum or CSF) to PHL for further testing.

B. Identify Potential Sources of Infection

Obtain a travel history and ask about arthropod exposures during the likely exposure period. In addition, ask about receiving blood products or about organ or tissue transplants.

C. Identify Potentially Exposed Persons

Identify others who traveled with the patient. Determine if the patient donated blood or organs, breastfed, or gave birth during the communicable period. If the patient donated

blood or organs, inform the blood or tissue bank of the potential exposure. In cases of potential mother-to-infant transmission, monitor the infant for compatible signs and symptoms.

D. Environmental Evaluation

Notify local environmental health program and/or vector control of locally acquired cases. In outbreak settings, an investigation may assist in identifying and controlling factors favoring transmission.

6. CONTROLLING FURTHER SPREAD

A. Infection Control

1. Hospitalized patients should be treated with standard precautions.
2. Infected persons should be advised not to donate blood, tissues or organs.
3. Infected lactating women should discuss breast-feeding with their medical care provider.
4. Patients being treated for acute dengue fever in the United States should be sequestered from mosquitoes while viremic to avoid urban transmission. Given that *Ae. aegypti*, the principle mosquito vectors, are not endemic to Washington State, the risk of the case infecting mosquitoes which could subsequently infect other humans is very low.

B. Case Management: No case follow-up needed.

C. Contact Management:

None, since arboviral infections are not transmitted from person-to-person.

D. Management of Other Exposed Persons:

Instruct others persons potentially exposed to the same source to seek medical attention if symptoms of arboviral disease develop.

E. Environmental Measures:

Environmental measures to reduce local arboviral transmission may include the elimination of mosquito breeding habitats and the use of chemical (i.e., pesticides) and biological controls. Consult with local environmental health or vector/mosquito control programs to determine appropriate intervention measures.

7. MANAGING SPECIAL SITUATIONS

Not applicable

8. ROUTINE PREVENTION

A. Immunization Recommendations

Japanese Encephalitis Vaccine

Persons planning to travel or reside in areas where Japanese encephalitis is endemic or epidemic should consult with a travel medicine health provider regarding the need for Japanese encephalitis vaccine.

To learn more about vaccine indications, contraindications and side effects, see the CDC website at: <http://www.cdc.gov/ncidod/dvbid/jencephalitis/qa.htm> and the

recommendations from the ACIP (Centers for Disease Control and Prevention. Inactivated Japanese Encephalitis Virus Vaccine Recommendations of the Advisory Committee on Immunization Practices [ACIP]. MMWR. Jan 8, 1993;42:11).

B. Prevention Recommendations

To prevent arboviral diseases, persons should avoid arthropod bites by:

- Wearing a long sleeve shirt, long pants, and a hat when going into mosquito- or tick-infested areas, such as wetlands or woods. Tucking pant legs into socks or boots and shirts into pants to keep ticks on the outside of clothing where they can be more easily spotted and removed.
- Using mosquito repellent when necessary. The most effective mosquito repellents contain the EPA approved active ingredients DEET (N, N-diethyl-m-toluamide), Picaridin, oil of lemon eucalyptus, or IR3535. Read and follow instructions on the label. Permethrin is another long-lasting repellent that is intended for application to clothing and gear, but not directly to skin. In general, the more active ingredient (higher concentration) a repellent contains, the longer time it protects against mosquito bites. Do not over use repellents. Take special care when using repellent on children.
- When traveling, use mosquito bed nets when exposure to mosquitoes may occur at night.
- Additional information regarding the use of repellents can be found on the CDC website at: http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm and <http://www.cdc.gov/ncidod/dvbid/westnile/RepellentUpdates.htm>.

Persons traveling to arboviral endemic areas should consult with a travel clinic health care provider regarding additional measures which should be taken in specific areas.

ACKNOWLEDGEMENTS

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UPDATES

July 2008: In Section 2C, the number of dengue fever cases reported each year was changed from 0–8 to 0–10.
In Section 8B, IR3535 was added as a safe and effective mosquito repellent.